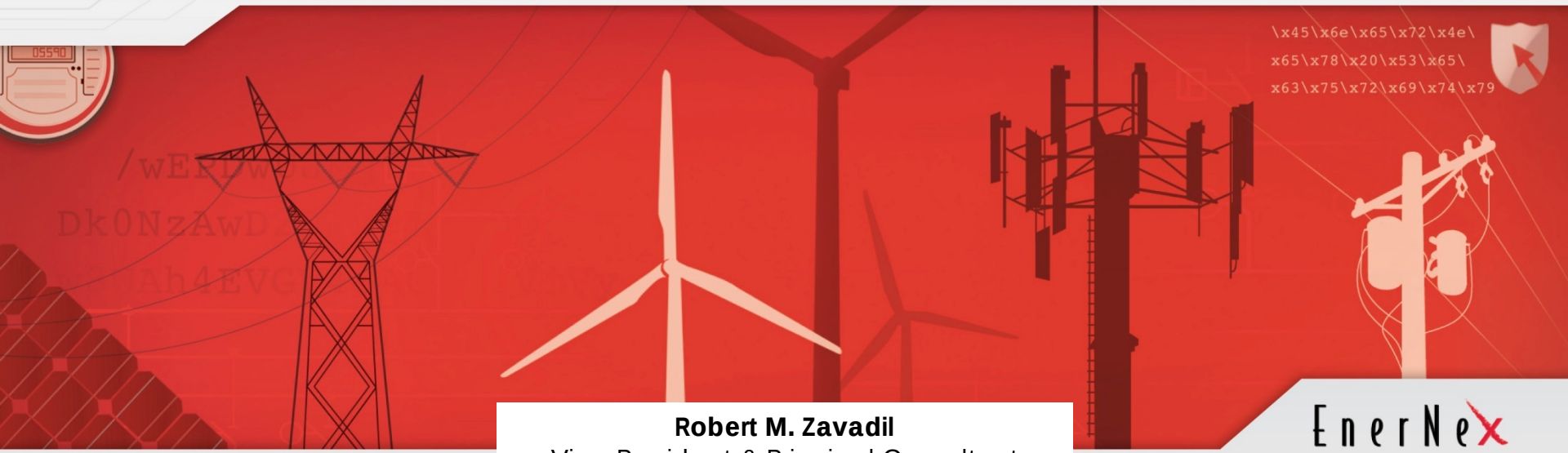
NASPI TECHNICAL WORKSHOP:
MODEL VALIDATION USING SYNCHROPHASOR DATA

TUESDAY, OCTOBER 22, 2013

Crowne Plaza Chicago O'Hare Hotel

5440 N. River Rd.

Rosemont, Illinois 60018



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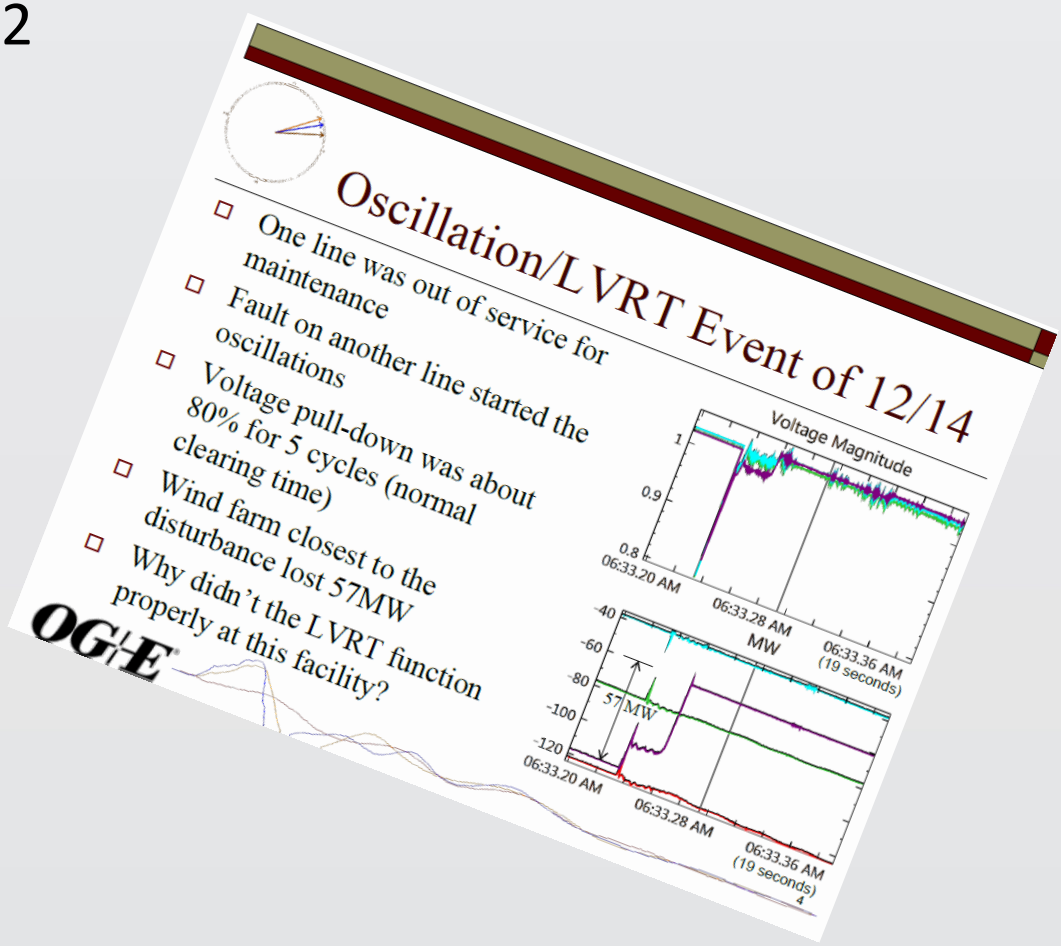
UVIG
Renewable Plant Model Validation Activities

- Utility Variable Generation Integration Group
- Initial support from BPA, DOE Office of Electricity
- Objectives
  - Inventory operating wind plants with POI monitoring (PMU or other device)
  - Determine if event data appropriate for model validation has been collected
  - Perform plan validation with field data
- Approach
  - Transient turbine and plant models (allow direct simulation of asymmetrical events) for initial validation
  - PSS/E or PSLF models validated against transient model
- Project Team
  - EnerNex
  - Hydro Quebec/IREQ
  - BPA

Validation Attempt for OG&E

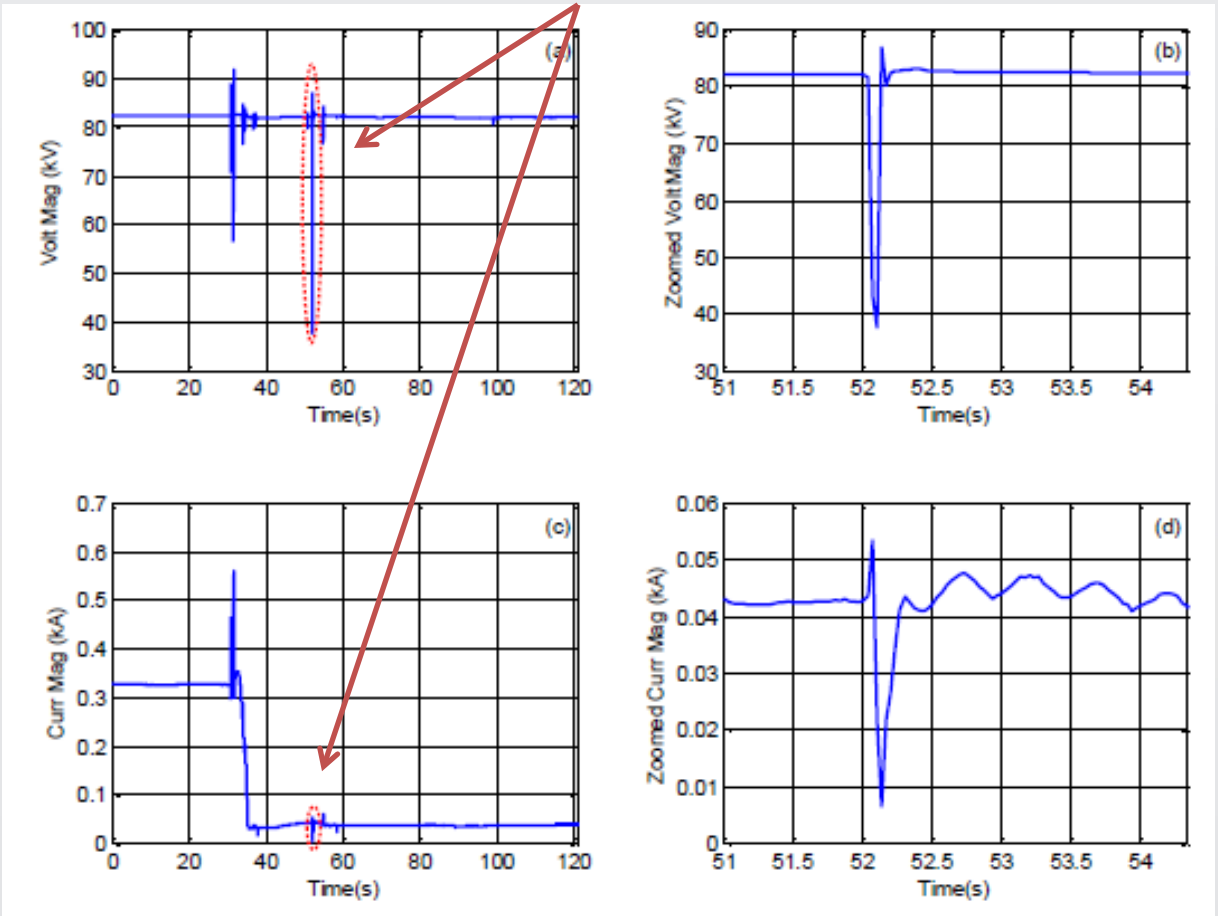
- OG&E presentation at 6/12 NASPI mtg.
- Significant wind generation, substantial PMU data
- Data provided to EnerNex by Austin White



OG&E PMU Data

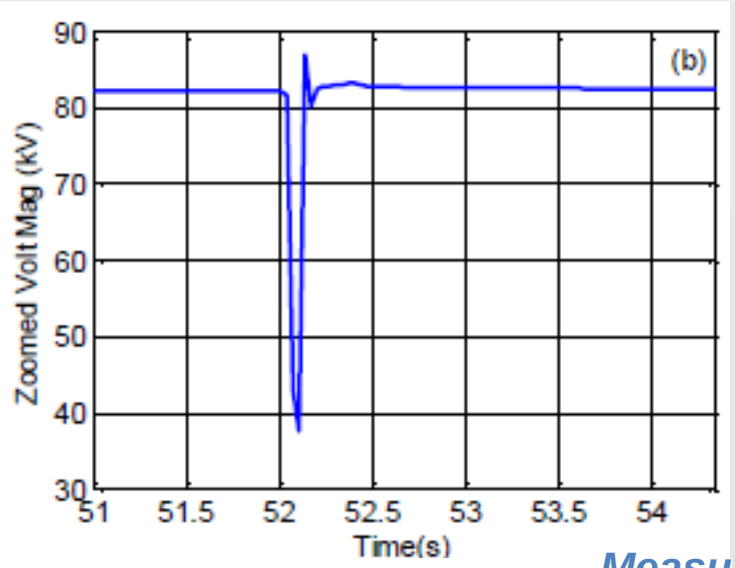
- Large number of recorded events screened
- Many were “small signal” – i.e. slight changes in terminal voltage
- Looking for large disturbances

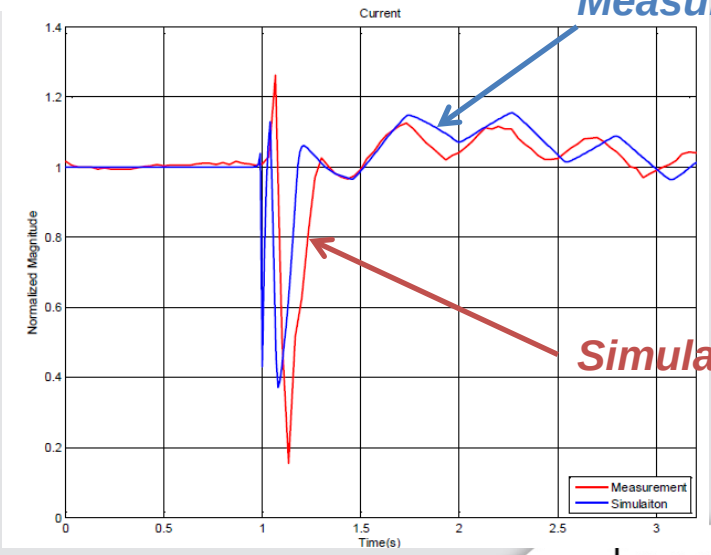
Complex event record with embedded large disturbance



Analysis

- Basic information about plant obtained from OG&E
- Type III generic model used to represent turbines
- Parameter sensitivity analysis conducted to iteratively adjust aggregate turbine model





Measurement

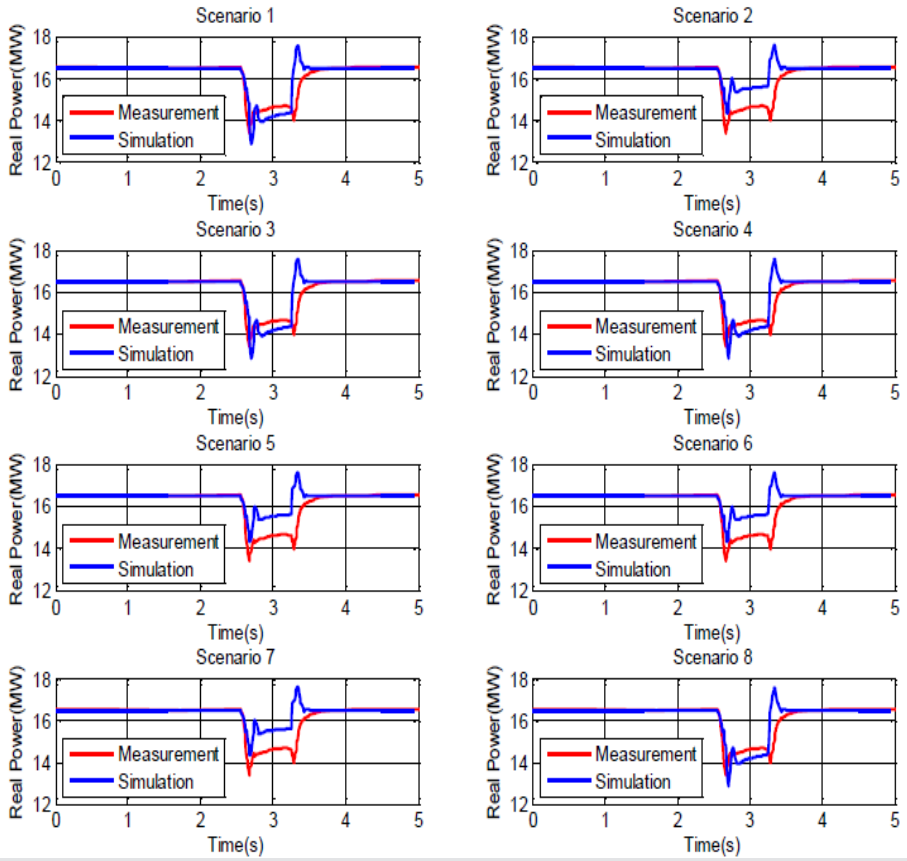
Simulation

Results

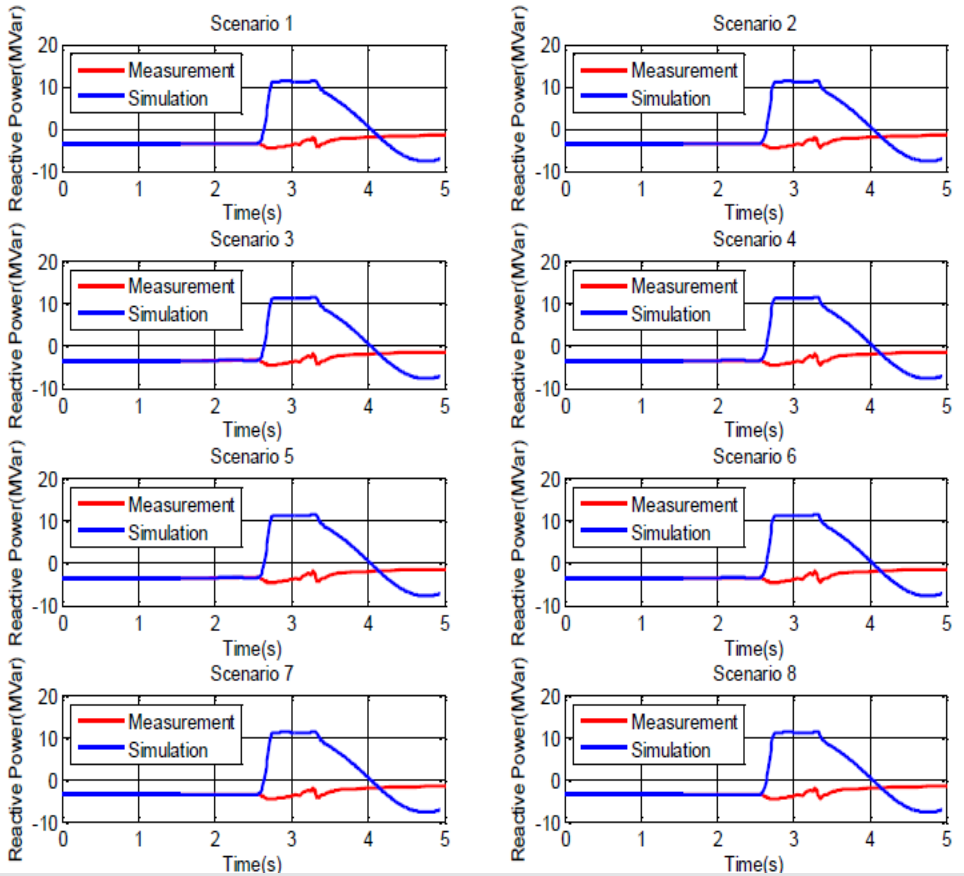
- Simulation/measurement correspondence is “reasonable”, but…
- Maybe more of a supporting data point than validation…
- What is “validation”, anyway?

Solar Plant Validation using Generic PV Plant Model

Real Power



Reactive



Lessons Learned

- Even with wide-scale deployment of PMU's, good data for validation is hard to come by.
- Good data is important, but not the only information requirement
- Participation of Transmission owner, plant operators in validation process would be very beneficial
- 1st generation of generic models may be lacking (good news: 2nd generation imminent)
- Validation process itself needs more formalization

Challenges

- A specific event may be hard to replicate via simulation
  - Plant model complexities
  - Initial conditions/system state
  - Origin and nature of system disturbance
- Actual events will be asymmetrical
  - PSS/E, PSLF models are positive sequence only
  - Unbalanced events model very approximately
  - 3-phase faults are rare
- Events are infrequent
  - With just a few monitored locations, appropriate data for validate may be long in coming
  - Can be partially remedied by monitoring at many locations
- Large number of commercial turbines to validate (60 GW + wind, 10 GW solar installed capacity = **100's of bulk power plants**)

UVIG
Renewable Plant Model Validation Collaborative

- New initiative
- Under the UVIG Modeling & Interconnection User Group
- Mission is to provide a venue for periodic and ongoing information sharing re: model validation
- UVIG will provide mechanism for information dissemination (modeling Wiki)
- Will meet twice yearly (prior to UVIG Spring & Fall workshops)
- Special workshop to be held 2Q 2014 (info forthcoming)

Thanks

- Be on lookout for Spring workshop details…

www.variablegen.org

Approaches for Model Validation

- Various methods can and have been used
- All have advantages and disadvantages